Detecting Early Widespread Metal Use in the Eastern North American Arctic around AD 500–1300

Patrick C. Jolicoeur

In the first millennium AD, peoples across the North American Arctic began to use and exchange metal. A group known as the Late Dorset (AD 500–1300) were the first to widely exchange metal in the Eastern Arctic. However, due to differential taphonomic processes and past excavation methods, metal objects in existing collections are rare although geographically widespread. This has led to metal being seen as a broadly exchanged but uncommon raw material among Late Dorset. This article expands the known scale of Late Dorset metal use by analyzing the blade slot thicknesses of bone and ivory objects from sites across the Eastern Arctic and comparing them to the thicknesses of associated lithic and metal endblades. These results demonstrate that Late Dorset used metal at least as frequently as stone for some activities. Given the few and geographically discrete sources, metal would have been exchanged over thousands of kilometers of fragmented Arctic landscape. The lack of similar evidence in earlier periods indicates intergroup interaction increases significantly with the Late Dorset. It is through these same vectors that knowledge and information would have flowed. Metal, consequently, represents the best material for understanding the maximum extent and intensity of their interaction networks.

Keywords: Arctic, archaeology, Dorset, Paleo-Inuit, Inuit, material culture, metal, interaction, Nunavut, Labrador

Au cours du premier millénaire après J.-C., les peuples de l'Arctique nord-américain commencent à utiliser et à échanger des métaux. Les Dorsétiens récents (500–1300 après J.-C.) ont été les premiers à échanger largement ces matériels en Arctique de l'Est (Canada et Groenland). Cependant, de nombreux processus taphonomiques, additionnés à d'anciennes techniques d'excavation archéologique, rendent la présence d'objets métalliques rare dans les collections muséales. Ceci a mené à la conception que le métal était une ressource peu commune, mais largement échangée par les Dorsétiens récents. Cet article contribue aux connaissances sur l'ampleur de l'utilisation des métaux par les Dorsétiens récents en analysant l'épaisseur des fentes d'emmanchements d'artéfacts osseux de sites dorsétiens de l'Arctique de l'Est et en les comparant avec l'épaisseur des lames lithiques et métalliques associées. Les résultats démontrent que les Dorsétiens récents utilisaient le métal aussi souvent que la pierre pour réaliser certaines activités. Par exemple, la majorité des têtes de harpons de Type G, un type que l'on retrouve uniquement auprès des sites du Dorsétien récent, ont des fentes d'emmanchement plus minces que la majorité des pointes lithiques. Ceci indique qu'ils devaient plutôt supporter des pointes en métal. De plus, aucune tête de harpon provenant de périodes plus anciennes ne semble avoir supporté des pointes métalliques. Étant donné que les sources connues de métal en Arctique de l'Est sont peu nombreuses, les métaux auraient été échangés sur des milliers de kilomètres à l'intérieur d'un paysage arctique fragmenté. L'absence de preuves similaires pour les périodes plus anciennes indique une augmentation rapide des interactions entre les groupes à la période du Dorsétien récent. C'est à travers ces mêmes vecteurs d'échange que les savoirs et connaissances auraient voyagé. Le métal représente ainsi le meilleur matériel pour comprendre l'étendue géographique et l'intensité des réseaux d'interactions chez les Dorsétiens récents.

Mots-clés: Arctique, archéologie, Dorsétien, Paléo-Inuit, Inuit, culture matérielle, métal, interaction, Nunavut, Labrador

Around AD 500, metal began to be used and exchanged in the Eastern Arctic (i.e., Canada and Greenland) in a more intensive and extensive way than what was previously seen in the region (Figure 1). The group that inhabited the Eastern Arctic at this time is known archaeologically as the Late Dorset (Figure 2; Appelt et al. 2016; Maxwell 1985).

Patrick C. Jolicoeur (patrick.jolicoeur@utoronto.ca, corresponding author) ■ Department of Anthropology, University of Toronto, 19 Russell Street, Toronto, Ontario, M5S 2S2, Canada

American Antiquity 86(1), 2021, pp. 111–132

doi:10.1017/aaq.2020.46

Figure 1. The North American Arctic with the names of major locations mentioned in the text.

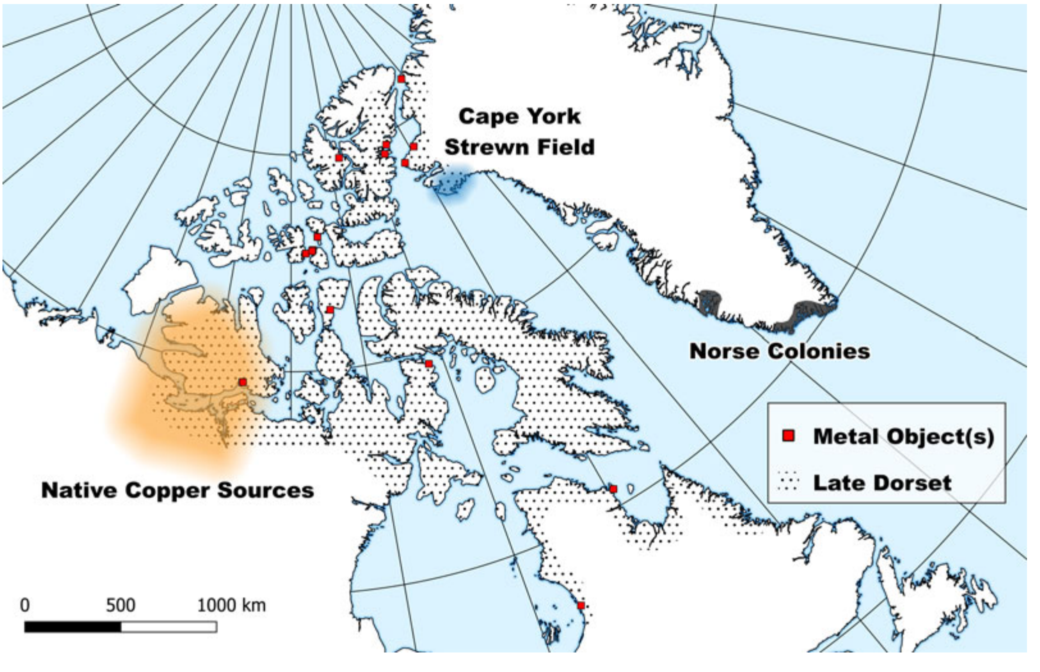

Figure 2. Location of potential metal sources and Late Dorset sites with surviving metal objects. (Color online)

https://doi.org/10.1017/aaq.2020.46 Published online by Cambridge University Press

The Late Dorset are the descendants of peoples that had lived in the Arctic since the first evidence of human presence in circumpolar North America around 3000 BC. They disappear from the archaeological record around the thirteenth to fourteenth centuries AD (Appelt et al. 2016; Appelt and Gulløv 2009; Friesen 2019; Savelle et al. 2012), which coincides with the eastward migration of the early Inuit—an archaeologically and genetically distinct group—from Alaska into Canada and Greenland (Fitzhugh 1994; Friesen and Arnold 2008; McGhee 2009; Pinard and Gendron 2009; Raghavan et al. 2014).

Importantly, the term "Dorset" is used here as it is the most common term in the archaeological literature. The name is derived from "Cape Dorset," the Euro-Canadian name for Kinngait, a community in southwest Baffin Island, where archaeological collections were first identified and defined for what we know now as the Dorset culture (Jenness 1925). The Dorset are thought to be the Tuniit of Inuit oral histories (e.g., Rowley 1994), and although an Inuit term is preferable over the archaeological designation from the author's perspective, there is no consensus among all stakeholders (e.g., Friesen 2015; Hodgetts and Wells 2016). As such, this article will use "Dorset" to refer to these peoples in order to remain consistent with the published record. This term represents similarities in the archaeological record only. How these Arctic peoples referred to themselves or how they understood any sociocultural divisions in the Eastern Arctic at this time is not known.

The emergence of the Late Dorset archaeological culture around AD 500 brings with it several changes (Appelt et al. 2016). This includes a reoccupation of High Arctic Canada and Greenland (Schledermann 1990), a region unoccupied during the Middle Dorset period for nearly 500 years; large aggregation sites spread throughout the Eastern Arctic (Damkjar 2000, 2005; Park 2003; Ryan 2003); a purported increase in the production of carved "art" objects (Taçon 1983); increasingly similar artifact styles (Appelt et al. 2016; Maxwell 1985); and the widespread use and exchange of copper and iron (Cooper 2016; McCartney 1991).

Assessing the extent and intensity of Dorset metal use has largely relied on surviving metal tools in museum collections (Cooper 2016; Farrell and Jordan 2016; Pike et al. 2019). However, probably due to past excavation techniques, differential preservation, and object curation on the part of the Dorset, metal is underrepresented in existing collections (McCartney 1988). Although new excavation methodologies have recovered proportionally more metal than previous work in Arctic sites (Appelt et al. 2015; LeMoine et al. 2003), Late Dorset metal is still recovered in relatively low quantities compared to other materials. This has led to the notion that metal was widespread but rarely used by Late Dorset groups.

Inuit contexts have produced proportionally more metal than Late Dorset contexts (McCartney 1988, 1991; McCartney and Mack 1973). This disparity might be a result of most early Inuit contexts being younger than some Late Dorset contexts as well as many Dorset sites being scavenged and disturbed by later Inuit activity (Park 1993, 2016). Research focusing on Inuit contexts has increased the scope of known metal use by measuring the thicknesses of blade slots on objects such as harpoon heads and knife handles. This demonstrated that many of these implements held metal blades if the blade slot was relatively thin, and they held either lithic or metal blades if the blade slot was relatively thick (Gullason 1999; Whitridge 2002). Dorset collections have not been reassessed in the same way, which has left an incomplete picture of what is almost certainly the earliest widespread evidence of metal use in the Eastern Arctic.

This article expands the known intensity of Late Dorset metal use by assessing the blade slot thicknesses of harpoon heads and knife handles, and it refines the methodology used by other researchers in Inuit contexts. The results confirm that metal is underrepresented in Late Dorset collections and provide a higher-resolution dataset for Late Dorset metal use than what was previously known. Casting metal as an intensively (i.e., used frequently for one or more activities) and extensively (i.e., used at many different sites) used and exchanged material presents one of the best opportunities for understanding the scope of Late Dorset social networks and its influence on the archaeological record.

Arctic Metal Use

Unlike incipient metal use in other parts of the world, there is no evidence of metal being smelted and forged by the Arctic peoples of North America, although there is evidence of smelted metals being acquired through trade (Cooper et al. 2016; Schledermann and McCullough 2003; Sutherland 2002, 2008, 2009; Sutherland et al. 2014). Rather, raw lumps of metal were cold-worked into their desired form and, in some cases, annealed (Buchwald 2001; Buchwald and Mosdal 1985; Cooper et al. 2015; Franklin et al. 1981). The few systematic studies of metal object manufacture in an Arctic context limits any cross-cultural comparison, but it is clear that metal was used differently by different peoples in the Arctic (Dyakonov et al. 2019; Franklin et al. 1981).

Potentially the earliest vestiges of metal use in the North American Arctic is found around the Bering Strait. Here, various groups—such as Ipiutak, Old Bering Sea, Punuk, and Birnirk—began to use and exchange metal throughout northwestern coastal Alaska and Chukotka (Mason 1998). The iron and copper-alloys identified in these Bering Strait sites were likely obtained through trade north from Asia (Cooper et al. 2016; Lebedintsev 2000; Mason 1998, 2000). The first traces of copper-alloy objects appear in Chukotka as early as the late second millennium BC, and iron appears in the early first millennium AD (Dyakonov et al. 2019:363; Mason 1998). Although the chronological data is imprecise, there is no evidence that this metal use extends across the Bering Strait into Alaska until the mid to late first millennium AD (Dyakonov et al. 2019:374). Native copper from the Copper River region of central Alaska also supplied metal to the coastal regions with the earliest evidence also falling in the late first millennium AD (Cooper 2012:566).

Despite the broadly similar timing, there is no evidence of these metals or other materials being exchanged with contemporary groups in the Eastern Arctic. Overall, aside from the few major population migrations throughout the human history of the Arctic, there is very limited evidence that groups east and west of the Mackenzie Delta interacted with any frequency until the last few centuries (Friesen and O'Rourke 2019:488). Although there has been considerable erosion around the Mackenzie Delta, this border region between the Western and Eastern North American Arctic appears to have been uninhabited during the emergence of metal use and could be a barrier for movement of materials or peoples (Friesen and O'Rourke 2019:496).

Eastern Arctic Metal Sources

In an Eastern Arctic context, there are effectively two main sources of metal located more than 1,000 km from each other (Figure 2). First, native copper was most likely acquired from the Coppermine River area and the adjacent Victoria Island (Farrell and Jordan 2016; Franklin et al. 1981). The wide distribution of this source area is probably due to native copper primarily coming in the form of "float copper," which is small nuggets or fragments transported by glacial or fluvial processes from their original formation (Franklin et al. 1981:5). There are other alternative copper sources in Central Labrador and Newfoundland, but there is no evidence of these sources being exploited by Dorset groups (Levine 1999:189). Furthermore, these sources are farther south than the southernmost extent of Late Dorset (Fitzhugh 1981:43).

In terms of iron, it was primarily collected from meteorite impact sites, with the Cape York meteorite strewn field in northwest Greenland being the largest and most likely source for most Late Dorset iron (Buchwald 2001; Buchwald and Mosdal 1985). It is possible, however, that smaller ferric meteorites were also exploited (McCartney and Kimberlin 1988). Recent research suggests that the Cape York meteorite impact occurred toward the end of the Pleistocene (ca. 12,000 years ago), thousands of years before the first traces of humans in the area (Boslough 2013; Kjær et al. 2018). Inuit groups collected "telluric iron" from Disko Bay in western Greenland, but this source lies far to the south of Late Dorset settlement in Greenland with no evidence of it being exploited by any group other than Inuit (Appelt et al. 2015:20; Buchwald 2001, 2005:36).

Finally, there is some indication that the Greenlandic Norse could have supplied smelted metals to contemporaneous Late Dorset and early Inuit groups. The scale of this source, however, is not completely understood (Schledermann and McCullough 2003; Sutherland 2008, 2009; Sutherland et al. 2014).

Evidence of Dorset Metal Use

The earliest evidence of metal use in the Eastern Arctic is found in Pre-Dorset (3000–500 BC) sites on Victoria Island (Taylor 1967) and around the Coppermine River (Clark 1975) near potential native copper sources. Other evidence of copper use by Pre-Dorset, Early Dorset (500 BC–AD 1), and Middle Dorset (AD 1–500) groups is not seen elsewhere in the Canadian Arctic and Greenland, or it is found in insecure contexts (Harp 1958). Curiously, there is no evidence of iron use by Arctic groups in High Arctic Canada and Greenland prior to the Late Dorset, despite the availability of the Cape York meteorite source. Ultimately, this limited picture of pre–AD 500 metal use suggests that it was rare and probably confined geographically to sites in the vicinity of native copper sources.

The earliest widespread use of metal begins with the Late Dorset after AD 500. Late Dorset sites with surviving metal objects are geographically widespread, despite rarely having more than a few objects at each site. The main exceptions are sites from Little Cornwallis Island (LeMoine et al. 2003), the High Arctic (Appelt and Gulløv 1999; Appelt et al. 1998; Schledermann 1990:261), and the western Canadian Arctic (Friesen 2004:687). Notably, some of these sites were surveyed with metal detectors, unlike most other Late Dorset sites, which might account for the difference in metal assemblage size.

Surviving native copper objects are found at sites around their source, but they were exchanged as far away as Ellesmere Island (Schledermann 1990:216) and northern Greenland (Appelt et al. 1998). The distribution of surviving meteoritic iron objects is slightly less widespread. These objects are found at sites around their source (Appelt et al. 1998; Schledermann 1990), in the Central High Arctic (LeMoine et al. 2003; McGhee 1981:75, 1984:5), and in northern Foxe Basin. Most of these objects appear to be utilitarian, or manufacturing or waste fragments. An amulet, probably made of European copper, in the shape of a harpoon head endblade that was found at Gulf Hazard 1 is a rare example of metal being used as personal adornment by the Late Dorset (Harp 1974). Additionally, at the Qeqertaaraq site in northern Greenland, there is a fragment of a European brass vessel, but it is unclear if it was used by the Dorset or curated as an already fragmented object (Appelt and Gulløv 1999:22; Appelt et al. 1998:152). In addition to these two examples of Norse origin, there is one copper-alloy object found at a Late Dorset longhouse in Tuvaaluk (Diana Bay) in Nunavik (northern Quebec; Plumet 1985:189) and a piece of wrought iron at the Late Dorset Lake Buchanan site on Axel Heiberg Island (Sutherland 2000:160). The results presented in this article cannot distinguish between the types of metal used, but they can expand our understanding of the scale of metal use.

Potential methods of detecting metal use other than the analysis presented here are possible, but they are outside the scope of this article. Most complementary to this study is using microscopy to examine possible copper or iron corrosion products left behind on bone or ivory harpoon heads and knife handles. The objects included in this study have been systematically analyzed in this manner, but those results will be reported separately given the scope of that work and its associated methodology (Jolicoeur 2019). Microscopy is not perfect, however, because numerous taphonomic and post-excavation processes can remove any detectable trace of metal use. Consequently, it is effective at distinguishing which types of metals were used but not necessarily at quantifying the scale of metal use on its own. Second, it is possible to assess the choice between using metal or stone by observing cutmarks on faunal evidence, as seen in Neolithic-Bronze Age contexts in Europe (Greenfield 1999, 2000). Similarly, it is possible to assess the raw material of a blade based on use-wear and manufacturing traces left behind on finished or partially finished bone or ivory objects. LeMoine (2005) analyzed Late Dorset carved bone and ivory objects from sites in the Central Arctic in this manner and found that metal was used as often as stone in the manufacturing process. This does not indicate, however, if this pattern is representative of other regions of the Eastern Arctic. Moreover, neither these results nor the examination of cutmarks left on faunal remains indicates the full scale of metal use because a single metal knife can manufacture many carved objects or butcher many animals. Examining blade slot thicknesses is a more robust measure than these other analyses for determining the scale of metal use.

Methodology

Blade slot thicknesses were measured from harpoon heads and knife handles from a variety of Early, Middle, and Late Dorset contexts across the Canadian Arctic to determine if they once held lithic or metal blades (Figure 3). To ensure that blade slot thicknesses relate to raw material choice and not simply different blade sizes, corresponding basal thickness measurements from lithic and metal tools were also recorded. "Blade slot thickness" is used here to mean the linear distance between both blade beds of a blade slot. Other studies use the term "blade slot width" to describe this same measurement, although the terminology is not consistent across previous work (Grønnow 2017; Gullason 1999; Whitridge 1999:259–270, 2002).

Fisher Scientific digital callipers were used for the measurements. These were measured to the nearest 0.01 mm. The instrument had an error range of 0.02 mm. Descriptive statistics and two sample t-tests assuming unequal variance (Welch's t-test) were calculated in Excel and R (version 3.5.2).

Following other studies (Gullason 1999; Whitridge 2002), it is unlikely that a thin blade slot would hold an endblade that is thicker than the slot itself. There are, however, some considerations that should be noted regarding this assumption. There is some ethnographic evidence that Inuit harpoon heads were heat treated or soaked in water to make their blade slots more malleable to accommodate a slightly thicker endblade (Boas 1965 [1888]:110). No charring was identified on any of the Late Dorset examples included in this study, but it is presently impossible to know if they were soaked in liquid. If this were the case, it is expected that the discarded harpoon head would retain the shape of the endblade it would have last supported. Unlike many early Inuit harpoon heads that have the distal tip of their blade slots warp backward, effectively pinching the

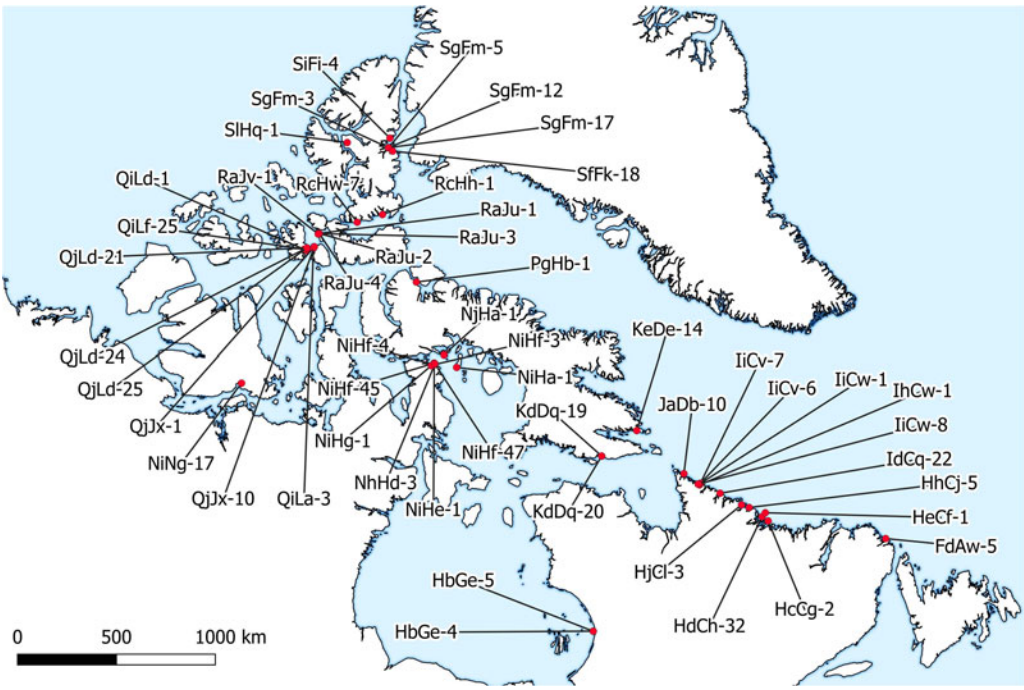

Figure 3. Location of all sites sampled in the dataset with the associated Borden number. (Color online)

https://doi.org/10.1017/aaq.2020.46 Published online by Cambridge University Press

endblade in place, none of the harpoon heads included in this dataset exhibited this attribute (Whitridge 1999:260).

On the other hand, it is possible that a thicker blade slot would support a thinner endblade. Ethnographic observations show that packing material was occasionally used to ensure a tight fit for thinner endblades in thicker blade slots (Whitridge 1999:261). Alternatively, other endblade securing techniques, such as using lashing or riveting, could also be employed. Therefore, a thick blade slot does not necessarily indicate that only lithic endblades were used, but a thin blade slot probably supported a metal endblade exclusively.

This dataset includes 183 harpoon heads made of ivory and antler from 27 sites in Nunavut and Labrador. Material was not sampled from Greenland or Nunavik. Harpoon heads that were included in this dataset have complete blade slots with both blade beds intact in order to facilitate measurements in three locations. The three locations represent the most distal portion of the blade slot, a proximal measurement located 1 mm from the most proximal portion of the blade slot, and a medial measurement representing the midpoint of the blade slot (Figure 4). These roughly equate to a thinnest (proximal), middle (medial), and thickest (distal) measurement of blade slot thickness. Frequently, in the few examples of harpoon heads with intact endblades, the most proximal portion of both the blade beds and endblade do not contact each other consistently. Moreover, given the wedge shape of most Dorset harpoon-head blade slots, the proximal measurements are less variable than the other two locations. For these reasons, the medial and distal measurements are relied upon for this analysis.

The harpoon-head data are compared to basal thicknesses measurements of lithic harpoon endblades that were probably intended to be mounted in a harpoon head's blade slot. This dataset includes 372 lithic endblades from 33 sites in Nunavut and Labrador. These come from a variety of Early, Middle, and Late Dorset contexts, and they represent a variety of lithic raw materials. As with the harpoon heads, endblade thickness was measured in three locations along the basal portion of the object (Figure 4), although the present study is again based only on the medial and distal measurements, which represent the area of most likely contact between the endblade and harpoon-head blade slot. The distal measurement represents the most distal point of basal thinning that is present. In the few cases where this thinning is not visible, the distal measurement was located at the center of the object. The distal measurement does not represent a maximum thickness that was recorded separately. The proximal measurement location was the basal edge of the endblade, and the medial measurement was the midpoint between distal and proximal measurements. Although there is a collection of attributes that were used for testing differences in endblade thickness, all examples are what Arctic archaeologists refer to as "triangular endblades." These are pressure flaked with generally straight lateral sides and a straight or concave base. They can be bifacially or unifacially flaked, and some Early and Middle Dorset examples have a distinctive "tip flute"—a lithic reduction technique involving removal of a pair of small elongated flakes from its distal tip (Plumet and Lebel 1997). "Thickness" for all lithic object measurements refers to the linear distance from one face of the object to the other.

The dataset also includes blade slot measurements on Dorset knife handles. These handles can have either end- or side-hafted blades. In this analysis, 23 end-hafted handles from four sites and 48 side-hafted handles from 11 sites are included. End-hafted handle measurement methods mirror exactly those used for harpoon heads. Side-hafted handle blade slots, however, were measured differently due to the profile of their blade slots not being exposed like those of end-hafted handles and harpoon heads. Measurements were instead taken on the accessible portion of the blade slot representing a proximal measurement, a most distal measurement (representing the midpoint of the blade slot), and a measurement between those two locations. This means the "distalmost" measurement for side-hafted blade slots is generally the thickest measurement (Figure 4). As a result, the side-hafted blade slot data are not directly comparable with the harpoon head or end-hafted handle data, but they are suitable for assessing

https://doi.org/10.1017/aaq.2020.46 Published online by Cambridge University Press

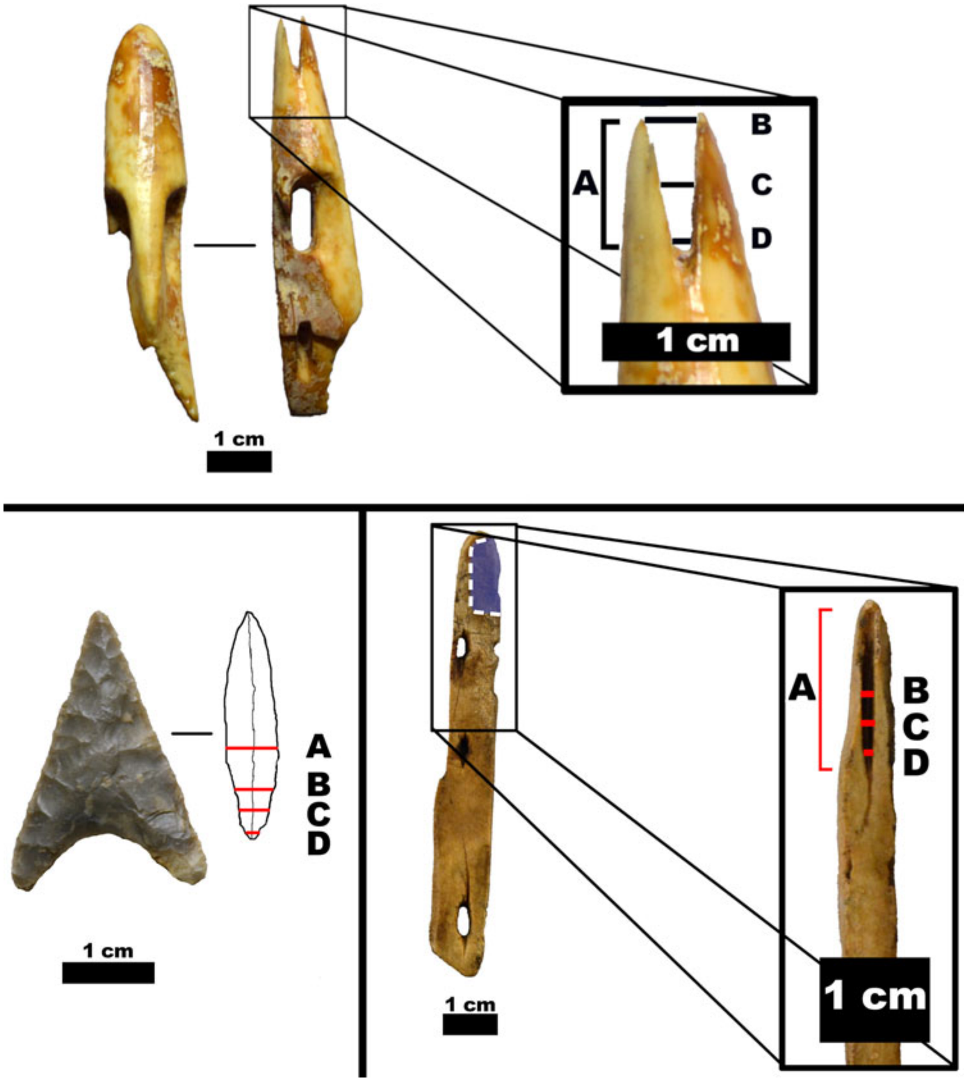

Figure 4. Measurement locations for harpoon heads (top), lithic endblades (bottom left), and side-hafted handles (bottom right). For the harpoon head and side-hafted knife handle, the blade slot (A) and the distal (B), medial (C), and proximal (D) measurement locations are noted. The dotted area indicates the profile of the side-hafted handle blade slot. For the lithic endblade, the maximum thickness (A), distal (B), medial (C), and proximal (D) measurement locations are noted on the diagrammatic cross-section. (Color online)

their thicknesses with the associated lithic tool measurements.

These knife-handle blade slot measurements were compared to the corresponding lithic tools that would have most likely been used. There are 115 scrapers from 22 sites, 29 burin-like tools from 11 sites, and 133 microblades from 19 sites included in this analysis. Scrapers and burin-like tools would have most likely been used with end-hafted handles, whereas microblades are the most likely lithic tool secured in side-hafted handles. Single basal thickness measurements were taken for burin-like tools and scrapers given that there is less variation in their hafting location morphology compared to endblades. Thickness measurements for microblades were taken on the mid-point of their lateral edge, the most likely point of contact with the distal measurement on side-hafted handle blade slots.

https://doi.org/10.1017/aaq.2020.46 Published online by Cambridge University Press

There are few metal objects in Late Dorset collections that are suitable for this analysis. Most sites have only fragments of metal with little indication of how they were used. Even sites with large assemblages of metal, such as those from Little Cornwallis Island (LeMoine et al. 2003), have few complete blades that would suit this analysis. The data here include 11 metal objects, all likely made of meteoritic iron, from the Franklin Pierce (SiFi-4) site (Schledermann 1990:261). This is a small, single component Late Dorset site, but it is one that contains a very wide range of metal tools.

Providing full details about these metal objects is outside of the scope of this article, but a brief description follows. The metal objects can be separated into three main categories: endblades ($n = 4$), stemmed endblades ($n = 5$), and side blades ($n = 2$). Metal endblades resemble their lithic counterparts. They are generally triangular and have flat or slightly concave bases. Stemmed endblades are similar to regular endblades, but they have a distinctive stem. Side blades are elongated, subrectangular blades that, unlike the other two types, seem to have been shaped to fit into a side-hafted handle. Some objects are not entirely finished, and they represent different steps in the manufacturing process. As such, although the thickness ranges presented below give an indication of Late Dorset metal blades, a larger sample is necessary to understand not only if these are representative but also how or if the thickness changes throughout the manufacturing process.

Results

Harpoon heads were separated into three categories that roughly correspond to chronology: (1) Pre-Late Dorset harpoon heads ($n = 38$), representing a variety of single line-hole types from Early and Middle Dorset contexts (Maxwell 1976); (2) Dorset Parallel harpoon heads ($n = 76$), a type found in Early, Middle, and Late Dorset contexts (Maxwell 1985; Park and Stenton 1999; Taylor 1968:52); and (3) Type G ($n = 68$), found exclusively in Late Dorset contexts (Park and Stenton 1999; Figure 5). These categories should help the data presented below demonstrate if metal use is detected in Early and Middle Dorset contexts, if an existing harpoon head type was adapted in any way during the Late Dorset period, and if a harpoon head type only found in Late Dorset contexts shows any evidence of metal use. Beyond this, these categories probably represent functional differences of the harpoon heads. Dorset Parallel harpoon heads, which tend to be slightly larger, have been interpreted as walrus-hunting harpoon heads, whereas Type G and smaller Early and Middle Dorset harpoon heads are thought to have been used primarily to hunt seal (Maxwell 1976:63; Murray 1999:474; Park and Mousseau 2003:264). This functional difference might explain the resilience of the Dorset Parallel type through time and its concurrence with other harpoon head types.

Comparing the three harpoon head categories based on the medial and distal measurements demonstrates clear differences (Figure 6; Table 1). The least variable group is the Pre-Late Dorset category despite its being the broadest in terms of physical attributes. Dorset Parallel harpoon heads tend to have the thickest blade slots. The exclusively Late Dorset Type G is variable, but its blade slots are thinner than the two other categories. The increased variability with Type G blade slots, despite the overall decrease in thickness, might indicate the need to create harpoon heads that could comfortably fit metal and lithic endblades. Dorset Parallel and Type G blade slot thickness correlate less strongly with overall object length, width, and thickness compared to Pre-Late Dorset harpoon heads (Table 1).

In order to evaluate how these blade slot measurements might indicate metal use, it is necessary to compare them with basal thicknesses of lithic endblades. There is good overall correspondence between Pre-Late Dorset and Dorset Parallel harpoon-head blade slot thicknesses and lithic endblade thicknesses. Conversely, 42 (61.8%) Type G harpoon heads have blade slots that are thinner than the majority of lithic endblades (<1.7 mm [medial] and <2.5 mm [distal]), with only 14 (3.8%) lithic endblades falling in that same segment. Furthermore, 35 (51.5%) Type G harpoon heads have blade slots that are thinner than all lithic endblades in this dataset (<1.4 mm [medial] and <2.0 mm [distal]). If the maximum rather than distal thickness

https://doi.org/10.1017/aaq.2020.46 Published online by Cambridge University Press

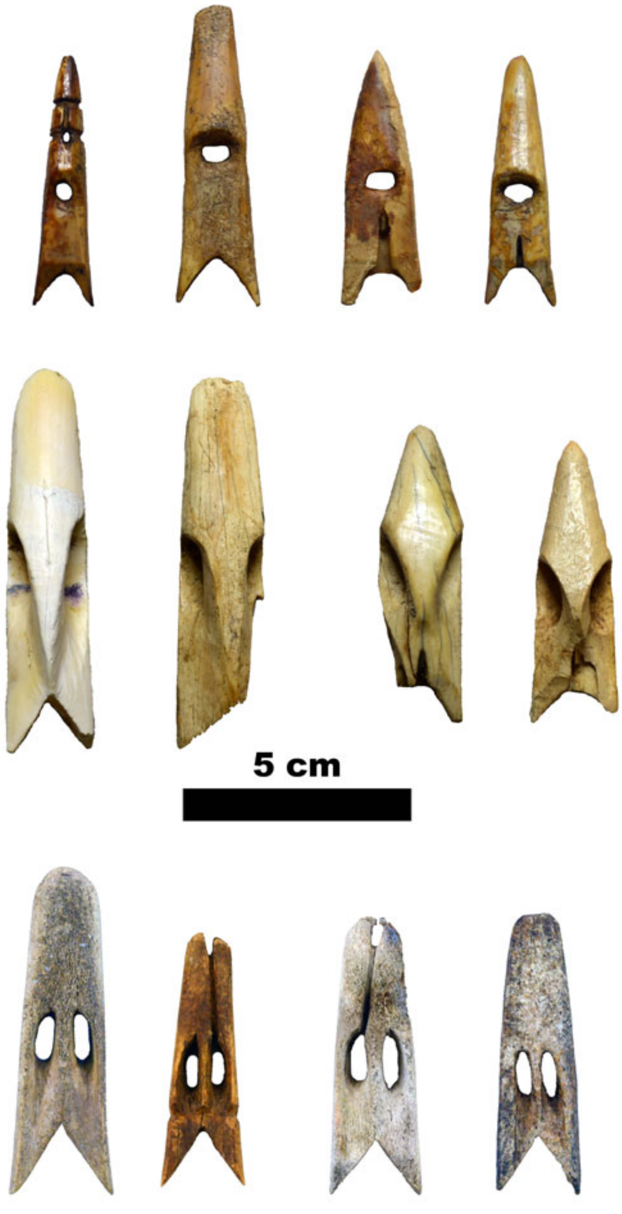

Figure 5. Examples of Pre-Late Dorset (top), Dorset Parallel (middle), and Type G (bottom) harpoon heads. Note the visible securing holes on the two central Type G harpoon heads. The grooves and perforation found on the distal portion of the first Pre-Late Dorset harpoon head are below the blade slot, indicating that they were not used to secure an endblade. (Color online)

measurement is used for endblades, the results are even starker (Figure 7). Despite the small size of the metal blade sample, there is a grouping of them that corresponds well to the thinnest segment of Type G harpoon-head blade slots.

Interestingly, differences in blade slot thickness also exist in Dorset Parallel harpoon heads when separated by time. All Dorset Parallel harpoon heads were separated into either Pre-Late Dorset or Late Dorset contexts, depending on

https://doi.org/10.1017/aaq.2020.46 Published online by Cambridge University Press

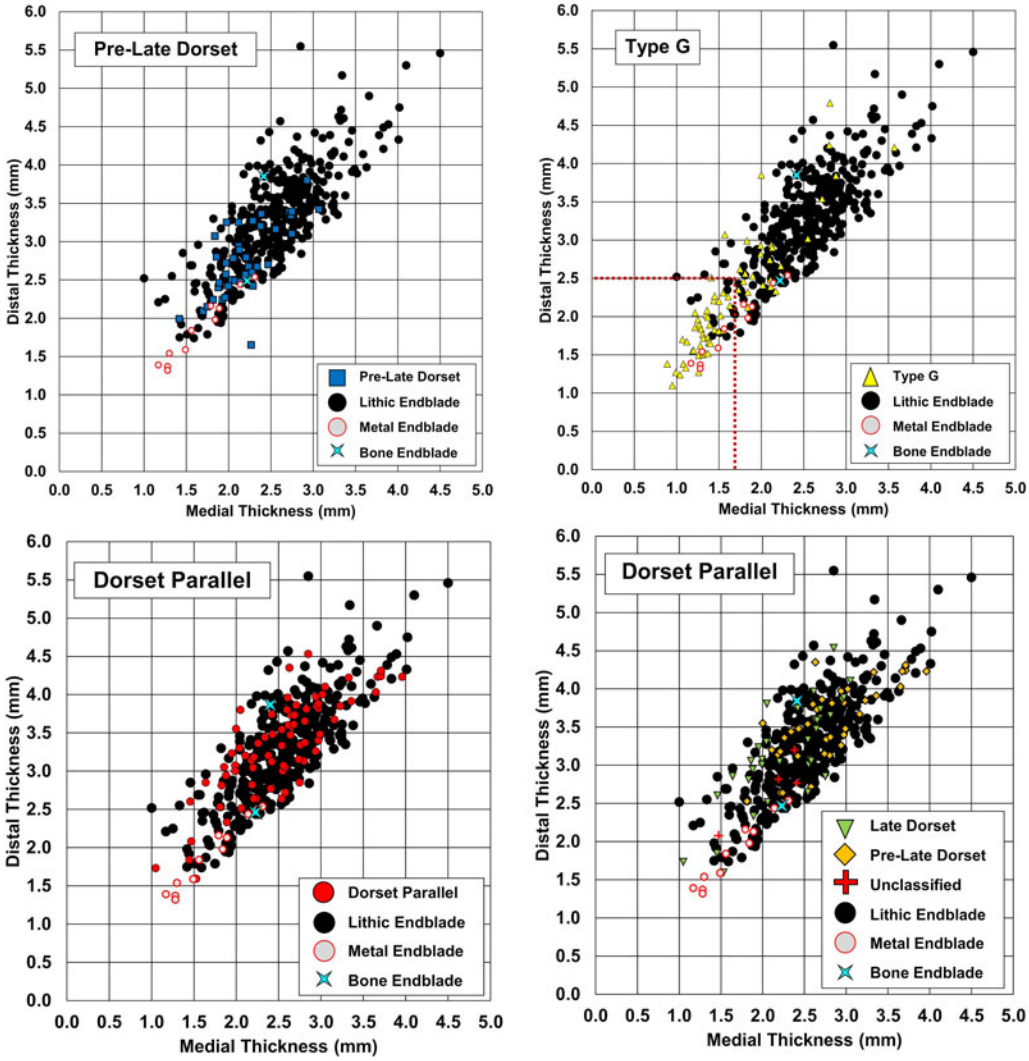

Figure 6. Comparison of medial and distal thickness measurements of endblades and harpoon head blade slots. The dotted area represents the thinnest segment of Type G harpoon heads that most likely held metal endblades. The endblade data are identical in each graph. (Color online)

available chronological data for their associated sites. Some examples had to be excluded from this procedure due to insufficient dating evidence or mixed site assemblages. In the end, the Dorset Parallel from Pre-Late Dorset contexts have thicker slots than those from Late Dorset contexts (Figure 6; Table 1). These observations are supported by applying Welch's t-test for these two groupings, which indicates a statistically significant difference between both medial and distal blade slot thicknesses with their associated time period (Table 2).

Another significant difference between the harpoon head categories relates to the presence of visible traces of hafting techniques used to attach the endblades to the harpoon heads. These are absent on Pre-Late Dorset examples included in this dataset, and they are incredibly rare in the published literature (Mary-Rousselière 2002:83–84). Different combinations of lashing grooves (i.e., circumferential grooves around the blade slot) and securing holes (i.e., a single perforation through both blade beds on the distal portion of the harpoon head) are rare with Dorset

https://doi.org/10.1017/aaq.2020.46 Published online by Cambridge University Press

Table 1. Descriptive Statistics of Harpoon Head Medial and Distal Blade Slot Thicknesses (top) and Overall Dimensions of Complete Harpoon Heads (bottom).

	Pre-Late Dorset		Type G		Dorset Parallel (All)		Dorset Parallel (Pre-Late Dorset)		Dorset Parallel (Late Dorset)	
	Medial	Distal	Medial	Distal	Medial	Distal	Medial	Distal	Medial	Distal
Mean	2.19	2.74	1.64	2.23	2.54	3.34	2.82	3.58	2.27	3.16
Median	2.13	2.69	1.45	2.07	2.58	3.37	2.78	3.55	2.48	3.07
σ	0.36	0.48	0.52	0.77	0.59	0.63	0.54	0.50	0.51	0.67
Range	1.65	2.15	2.68	3.69	2.91	2.94	2.15	1.82	2.00	2.94
Min	1.42	1.65	0.89	1.10	1.05	1.59	1.81	2.53	1.05	1.59
Max	3.07	3.80	3.57	4.79	3.96	4.53	3.96	4.35	3.05	4.53
n	38	38	68	68	76	76	38	38	34	34

	Pre-Late Dorset			Type G			Dorset Parallel (All)		
	Length	Width	Thickness	Length	Width	Thickness	Length	Width	Thickness
Mean	47.45	12.93	9.81	57.49	15.92	8.29	67.12	16.94	14.87
Median	47.63	12.16	9.19	59.70	15.22	8.32	69.76	18.15	15.25
σ	7.66	3.12	2.51	8.97	3.14	1.80	17.37	3.29	3.33
Range	32.40	16.11	11.25	42.90	15.10	12.08	74.87	14.89	13.39
Min	33.01	8.54	6.23	33.71	8.71	4.55	19.96	8.68	7.07
Max	65.41	24.65	17.48	76.61	23.81	16.63	94.83	23.57	20.46
n	36	36	36	57	57	57	51	51	51
Pearson's *r* (medial)	0.360	0.483	0.604	0.417	0.247	0.428	0.224	0.592	0.312
Pearson's *r* (distal)	0.489	0.469	0.580	0.427	0.260	0.457	0.406	0.591	0.520

Note: All measurements are in mm.

Parallel examples (5.2%), but they are present on 66.2% of Type G harpoon heads in this dataset. Securing holes alone occur on 35.1% of Type G harpoon heads. This indicates that the endblade that had been hafted would also need a perforation for these securing holes to be functional. This is physically impossible for flaked-stone endblades, and it would probably indicate that metal, bone, or ground-slate endblades had been used with those specific harpoon heads. Single perforations located along the midline of metal endblades are known in the published literature, but all examples are made of copper (Appelt et al. 1998:152)

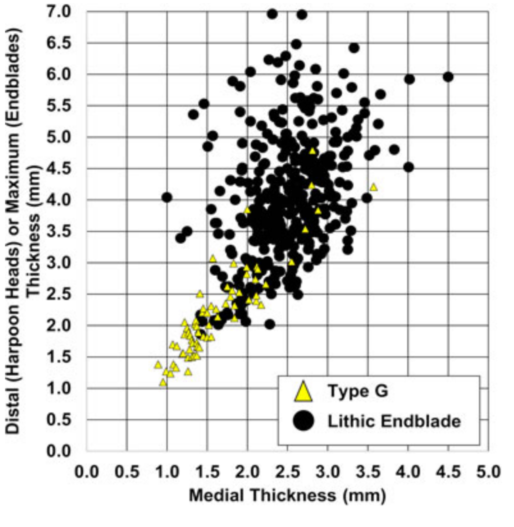

Figure 7. Distal and medial Type G blade slot thickness compared to maximum and medial thickness of lithic endblades. (Color online)

Fully detailing Late Dorset harpoon-head hafting techniques is outside the scope of this article, but the presence of bone and slate endblades are poor explanations for the emergence of securing holes on Late Dorset harpoon heads. Bone endblades are very rare in Late Dorset collections. An antler endblade found at QjJx-1 (Arvik) on Little Cornwallis Island has a perforation, suggesting that it was used in conjunction with a harpoon head with a securing hole (LeMoine et al. 2003:260). The only other organic endblade identified and included in this dataset is an ivory point from SgFm-3 (Longhouse) on Ellesmere Island (Schledermann 1990:215). It has no perforation and is fairly narrow, resembling a prong more than an endblade. These two examples have medial and distal thicknesses well within the range of lithic endblades. More examples of bone endblades are needed to understand the scope of its use and to determine if the rarity in existing collections accurately represents reality or if, in the same way as metal, it is an underrepresented object type. It should be noted, however, that many Late Dorset sites have excellent organic preservation, and bone endblades are not present at sites other than QjJx-1 and SgFm-3. The presence of securing holes on harpoon heads, especially those with thin blade slots, probably represent metal endblade use with those with thicker slots representing either metal or bone endblades.

Slate endblades become increasingly rare in the Late Dorset period and are more commonly referred to as "lances" due to their increased size rather than their flaked stone counterparts (Maxwell 1985:224, 227; Odess 1998:428). A number of Early and Middle Dorset sites have produced slate endblades or lances with side-notching, but most do not have any sort of perforation (Fitzhugh 1975:366; Mary-Rousselière 2002:133, 179; Maxwell 1973:52, 135; Renouf and Bell 2008; Taylor 1968:121). Those that have perforations, found mostly in Newfoundland, have paired sets of perforations along the lateral margins of the object, with only larger slate lances having a single midline perforation. This suggests that they were hafted to some sort of foreshaft rather than a harpoon head with a securing hole (e.g. Linnamae 1975:119; Tuck 1976:95). Ultimately, slate endblades probably do not account for the presence of securing holes on Late Dorset harpoon heads.

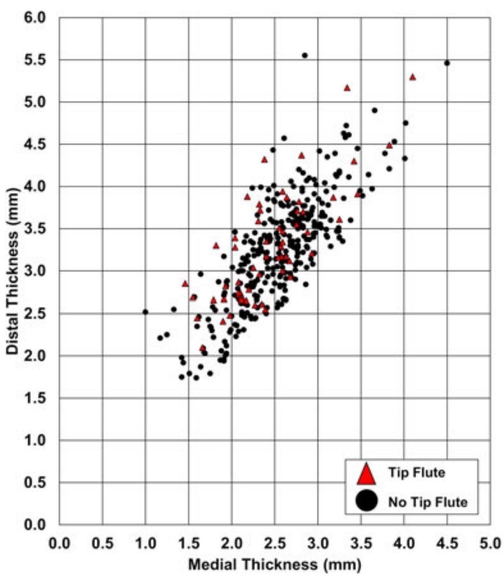

Figure 8. Medial and distal basal thicknesses for endblades with and without tip fluting. (Color online)

Non-slate lithic harpoon endblades are very common in all Dorset sites, but they cannot be separated into chronological categories as easily as harpoon heads, given that there are few identifiable physical attributes that can be confidently used Arctic-wide to associate an endblade with a specific time period. One exception is that Early and Middle Dorset endblades are occasionally tip fluted, but they are completely absent in Late Dorset contexts (Plumet and Lebel 1997). Basal thickness is not significantly different between lithic endblades regardless of their physical attributes, including tip-fluted and non-tip-fluted specimens, which suggests that they did not become thinner in later periods, unlike harpoon-head blade slots (Figure 8; Table 2).

Similar patterns are not seen in cases where lithic blades are roughly the same thickness as metal counterparts. End-hafted handles do not have relatively thin blade slots compared to the associated lithic tools. Lithic tool types that would have been secured in end-hafted tools, such as scrapers and burin-like tools, are similar to or thinner than corresponding blade slot thicknesses on end-hafted handles (Figure 9). Similarly, Dorset side-hafted blade slots are not significantly thinner than the majority of microblades, the most likely lithic tool type that would have been used. This is because microblades are generally very thin, much like metal blades. As a result, blade slot measurements, in these cases, do not allow differentiation between raw materials. Given the data presented by LeMoine (2005), future use-wear analysis has significant potential for clarifying the uncertainty with the knife-handle blade-slot results.

Expanding Late Dorset Metal Use

These results demonstrate that (1) no clear evidence exists for metal being used by the Early

https://doi.org/10.1017/aaq.2020.46 Published online by Cambridge University Press

Table 2. Welch's T-Tests Comparing Dorset Parallel Blade Slot Thickness across Time (top) and Basal Thickness of Lithic Endblades with Their Physical Attributes (bottom).

Dorset Parallel Blade Slot Thickness					
	T Stat	T Crit	P-Value	Late Dorset (*n*)	Pre-Late Dorset (*n*)
Medial	−4.40809	1.994437	1.84E-05	34	38
Distal	−2.99324	1.999624	0.003982	34	38
Lithic Endblade Basal Thickness					
	T Stat	T Crit	P-Value	Tip Flute (*n*)	No Tip Flute (*n*)
Medial	−0.687140	1.990063	0.493982	61	311
Distal	1.125435	1.991673	0.263946	61	311
				Unifacial (*n*)	Bifacial (*n*)
Medial	−1.568620	1.997138	0.121592	47	325
Distal	−0.465690	1.998341	0.643046	47	325
				Concave (*n*)	Straight (*n*)
Medial	0.335175	1.992543	0.738442	309	63
Distal	0.376168	1.992543	0.707876	309	63

and Middle Dorset, (2) metal began to be intensively and extensively used by Late Dorset groups, (3) and metal was incorporated into an existing technological system.

Pre-Late Dorset harpoon heads and Dorset Parallel harpoon heads from Early and Middle Dorset contexts have blade slots that are within the range of lithic endblade thicknesses. Despite blade slot thicknesses of Dorset Parallel harpoon heads overlapping with lithic endblade thicknesses, it is striking that examples from Late Dorset contexts have generally thinner blade slots than those from earlier contexts. This shift in blade slot thickness, as well as the majority of Type G harpoon heads having very thin blade slots, must represent the incorporation of a new endblade raw material. The increase in evidence for endblade hafting techniques in both Type G and Dorset Parallel harpoon heads, particularly the presence of securing holes, might also reflect this attempt at adapting harpoon head design for thinner metal endblades.

It is not impossible that thin lithic harpoon endblades, like metal endblades, are also underrepresented. Likewise, it is possible that bone endblades are equally archaeologically invisible. However, with the evidence of thinner blade slots in both new and established harpoon head types, increased prevalence of endblade hafting techniques, and the lack of correspondence between blade slots and both lithic and bone endblades, the most parsimonious explanation is that metal endblades were first being used by the Late Dorset and that their usage was much more common than the existing metal collections indicate.

Importantly, lithic technology does not disappear after metal begins to be widely used. Some Type G harpoon heads, and certainly most Dorset Parallel harpoon heads from Late Dorset contexts, could hold a lithic endblade. Additionally, the knife handle data, where there is no shift in blade slot thickness, suggest that Late Dorset probably did not have a need to create thinner blade slots because lithic blades were already as thin as metal (as in the case of microblades) or because there was no desire to switch to metal blades. Taken together, metal is clearly incorporated into an existing technological system that contrasts with some early Inuit contexts where lithic material is rare, which suggests that metal was being used as a replacement (McGhee 1984).

The likely metal-bearing harpoon heads are also geographically widespread throughout the Eastern Arctic and, significantly, are prevalent at most sites that were sampled (Table 3). Of the sites that have Type G harpoon heads, 61.8% have at least one specimen with a blade slot that is within the thinnest segment that would have likely held a metal endblade. All sites with more than one Type G have at least one specimen in that thinnest segment, suggesting that most sites had access to metal. The site with the largest sample size in the dataset, Brooman Point (QiLd-1; Park 2003), has 66.7% of its 33 Type G harpoon

https://doi.org/10.1017/aaq.2020.46 Published online by Cambridge University Press

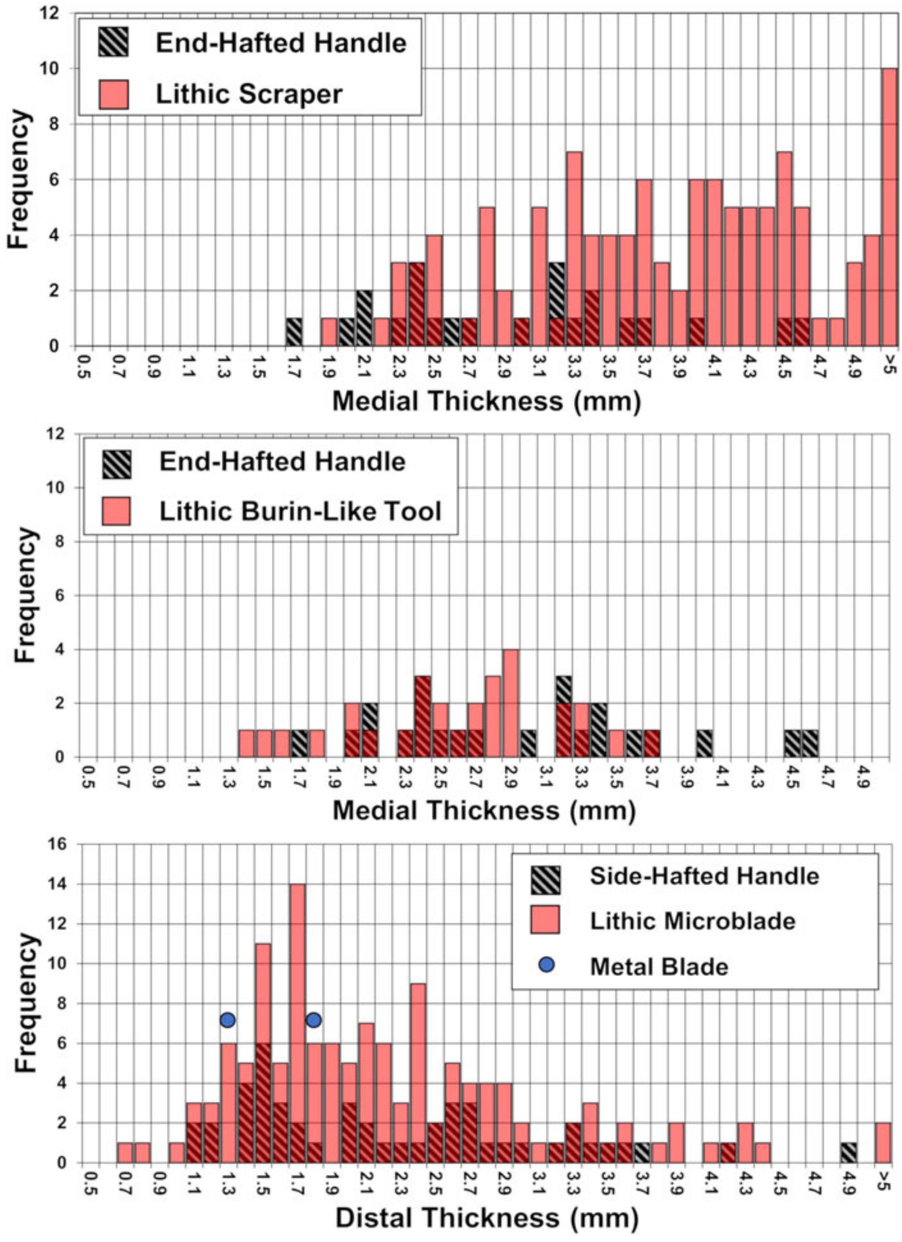

Figure 9. Comparison of end- and side-hafted knife handle blade slot thicknesses with relevant lithic tools. Only a single measurement is used given the limitations of the lithic tools that are being compared. The two metal objects from SiFi-4 that could have been secured in side-hafted handles have their medial thicknesses marked with dots. (Color online)

heads in the thinnest cluster. Significantly, this site, located on the east coast of Bathurst Island, is over 800 km away from known copper and iron sources. Interestingly, the only site with more than one Type G harpoon head that has less than 50% of specimens in the thinnest segment is the Longhouse site (SgFm-3) on Ellesmere Island (Schledermann 1990:216), one of the closest sites in the dataset to Cape York, with 33.4% of Type G harpoon heads likely holding metal endblades. Consequently, this hints that metal use was not closely tied to geographic

https://doi.org/10.1017/aaq.2020.46 Published online by Cambridge University Press

Table 3. Number of Type G Blade Slots within or outside Thinnest Cluster (<1.7 mm medial and <2.5 mm distal) at Each Site and Their Approximate Linear Distances from Metal Sources.

Site Borden Number	Common Name (if applicable)	Within Thinnest Cluster	Outside Thinnest Cluster	Percentage (%) within Thinnest Cluster	Approx. Linear Distance from Cape York Meteorite (km)	Approx. Linear Distance from Coppermine River Sources (km)
NiHf-4	Tikilik	5	1	83.0	900	1,200
NiHg-1	Abverdjar	0	1	0.0	900	1,200
NjHa-1	Kapuivik	0	1	0.0	850	1,250
NiNg-17	Cadfael	0	1	0.0	1,500	300
PgHb-1	Nunguvik	1	0	100.0	550	1,300
QiLa-3		1	0	100.0	850	1,000
QjLd-1	Brooman Point	22	11	66.7	850	1,000
QjLd-25		1	0	100.0	850	1,000
QiLf-25		1	1	50.0	850	1,000
QjJx-1	Arvik	3	3	50.0	800	1,000
RaJu-1	Snowdrift	0	1	0.0	600	1,100
SgFm-3	Longhouse	2	4	33.4	400	1,600
SgFm-5	Cove	2	0	100.0	400	1,600
SgFm-12	Narrows Point	0	1	0.0	400	1,600
SgFm-17	Shelter	0	1	0.0	400	1,600
SiFi-4	Franklin Pierce	3	0	100.0	450	1,650
SlHq-1	Bear Track	1	0	100.0	600	1,500
Total		**42**	**26**	**61.8**		

Note: Distance rounded to the nearest 50 km.

distance from potential metal sources. Given this prevalence, Late Dorset interaction networks must have been widespread and effective.

Although there are no other materials that are known to have been exchanged over the same distance, the lack of a distance-decay pattern between the source region for the material and its ultimate deposition is also seen in Late Dorset soapstone exchange in Labrador (Nagle 1984:361–414). Although there are a number of potential sources of soapstone in Labrador, and it did not travel as far as metal does in the rest of the Arctic, Late Dorset sites in Labrador have relatively even proportions of soapstone from each known source in terms of both manufacturing fragments and finished vessels. Nagle (1984:413) argues that even though there is no single explanation for the distribution of soapstone in Labrador, it probably fits into a multifaceted exchange network. The Late Dorset metal exchange can be profitably understood through this same lens. Metal itself was not exchanged in isolation—it was a single component in larger interaction networks. Both of these materials demonstrate the complexities of Dorset exchange networks in terms of space, time, and materials, and future research can profitably explore the interconnectedness of different materials across and through Dorset interaction networks.

Metal Use as Interaction Networks

This new analysis does not greatly expand the geographic extent of Late Dorset metal use given that surviving metal objects are already known from throughout the Eastern Arctic. The important contribution of this study is that metal must have been circulating at a high rate through expansive interaction networks. Because known sources of metal in the Arctic are both geographically discrete and far apart, increasing the intensity of known metal use also intensifies the amount of inter-group interaction that occurred. Although harpoon heads are simply a single category of use, they are good proxy indicators for metal use. It is important to note that harpoon head endblades are the first point of contact when a harpoon is thrown or thrusted into an animal and, as such, there is a high risk of them being lost or

https://doi.org/10.1017/aaq.2020.46 Published online by Cambridge University Press

damaged (Gullason 1999:524; McCartney 1988:115). It is likely that multiple endblades might have been created for a single harpoon head. Therefore, a single harpoon head with a thin blade slot might indicate multiple metal endblades. Unlike previous work that looked at the choice of using either stone or metal to manufacture carved bone objects where a single metal blade could manufacture multiple objects (LeMoine 2005), this analysis better quantifies how much metal must have been used since each harpoon head holds a single endblade, and endblades themselves are replaced more often than the harpoon head. Furthermore, it is likely that metal was used in other ways, such as for the production of amulets or "art" (Harp 1974), that will remain unknown until the metal objects themselves are recovered. Therefore, this analysis represents a minimum estimate of Late Dorset metal exchange.

Most striking is that the few and geographically distant source regions of metal, its high frequency of use, and the lack of mobility technologies common in Inuit context—such as dog sleds (Ameen et al. 2019; Morey and Aaris-Sørensen 2002) and large watercraft (Mary-Rousselière 1979)—do not seem to have limited the amount of inter-group interaction among the Late Dorset (Appelt et al. 2016; Desrosiers 2017; Maxwell 1985; Odess 1998). Using a least-cost path analysis to estimate travel times between native copper sources and sites with existing copper objects, Pike and colleagues (2019) demonstrate that most sites are over 112 hours of travel (i.e., 14 eight-hour days) in the warmer months, with roughly 30% of sites requiring more than 200 hours of travel (i.e., 25 eight-hour days). Although their analysis includes both Dorset and Inuit sites, this is a rough estimate of the significant time investment associated with any given metal object.

Although the exact networks that supported this metal exchange are unknown, it is likely that they flowed through common interaction networks established by the Late Dorset. Longhouse sites are one site type that might illustrate these networks. The purpose of Late Dorset longhouse sites has been long debated, but they are frequently interpreted as seasonal gathering sites (Appelt and Gulløv 1999; Plumet 1985; Schledermann 1990). Interestingly, Damkjar (2005:156) has shown that harpoon heads, particularly Type G, are recovered more frequently at longhouse sites than at other Late Dorset site types. Based on the analysis presented here, these harpoon heads might then be reasonable proxy indicators of metal use. Therefore, longhouses might represent the vectors that would have supported the high-intensity metal exchange described in this study (Appelt and Gulløv 1999). In this regard, it is not surprising that the longhouse site of Brooman Point (QiLd-1) has a large amount of metal use evidence despite its distance from known metal sources. Although the frequency of longhouse site gatherings is unknown, annual or semiannual aggregations at these sites would easily support the multiday travel times between metal source and most sites in the Eastern Arctic (Pike et al. 2019).

Most importantly, however, the information that would have underpinned supposed similarity in "art" styles, architecture, and artifact typologies (Appelt et al. 2016; Damkjar 2005; Darwent et al. 2018; Darwent et al. 2019; Odess 1998; Ryan 2003; Taçon 1983) would have flowed through these same channels. It is impossible at this stage to determine if intensive interaction and knowledge exchange facilitated the movement of novel raw materials or if it was the increased demand for metal and its cultural associations that helped develop the classic Late Dorset cultural similarities seen in the archaeological record. Moreover, longhouse sites themselves might have facilitated or, alternatively, been a symptom of these intensive interaction networks. Ultimately, these factors are clearly intertwined, and they contributed to each other. This merits future research, with this study representing an initial step toward clarifying these issues.

Conclusion

Metal becomes widely used across the North American Arctic around the middle of the first millennium AD. Significantly, there is little evidence for the connection between the metal use seen in the Bering Strait and the Eastern Arctic, suggesting that the material usage was independently developed (Dyakonov et al. 2019; Friesen and O'Rourke 2019). In the case of the Eastern Arctic, metal becomes a widespread and intensively used material around AD 500, corresponding with the Late Dorset archaeological culture. The assumption that metal is underrepresented in the Late Dorset archaeological record has been largely confirmed by this study. Moreover, this study has demonstrated that it is possible to understand the use and exchange of a raw material even when that material no longer exists.

Late Dorset people began to exchange metal on an extensive and intensive scale. Although lithic technology is not entirely replaced by metal, the two materials were used in parallel with each other. In particular, this study has demonstrated that (1) Late Dorset created metal endblades in conjunction with a new harpoon head type (Type G) that was not used in earlier time periods and (2) that they potentially adapted an established harpoon head type (Dorset Parallel) to facilitate a thinner metal endblade. In the case of Type G harpoon heads, metal endblades were used at least as frequently as stone. Additionally, most sites showed at least some evidence of metal use, whereas only sites with single harpoon heads had no evidence. Some sites with evidence of metal use, such as Brooman Point (QiLd-1), are situated hundreds of kilometers away from source regions of the material. In this regard, metal is a keystone material for understanding the maximum extent and intensity of Late Dorset interaction networks.

Late Dorset metal use contrasts significantly with earlier examples of Pre-Dorset and Dorset metal use, which is small scale and regionally bound (Taylor 1967), and it is more similar to the scope and scale of the exchange networks that develop across the Bering Strait at roughly the same time (Cooper 2012; Dyakonov et al. 2019; Mason 1998). However, unlike in the Bering Strait, where it is still unclear whether technologies or knowledge were also exchanged between different cultures, Late Dorset groups shared common architecture, material culture, and probably other elements of culture. It is through these same metal exchange networks that what it meant to be Dorset flowed (Appelt and Gulløv 1999; Damkjar 2005).

The methods used here are significant for other regions where composite bladed technology was used and the raw material of the blade is debated. This is especially relevant for questions around the earliest metal use in Chukotka, the Bering Strait, Sub-Arctic Alaska, the northern Pacific Coast of North America, and the Great Lakes region (Cooper 2016; Mason 1998). Furthermore, unlike other methods for measuring blade slots, a greater amount of flexibility is afforded by using multiple measurements to summarize the thickness of both the blade slot and the blade itself. Relying only on a single variable would potentially obscure relevant patterns.

Significantly, by expanding the evidence of known metal use, it is possible to refine the ways groups interacted with each other. Taking a raw material–centric approach for understanding past interaction networks is common in other regions (Bassett et al. 2019; Hill et al. 2018; Loring 2002, 2017; Lothrop et al. 2018; Lulewicz 2019; McCaffery 2011; Pike et al. 2019; Walder 2019), but this study demonstrates that it is possible to ask similar questions even when the raw material in question cannot be physically analyzed. Moreover, this approach complements traditional provenance studies analyzing sourcing, exchange, and network analysis by adding a robust way of understanding the scale of past interaction networks in a quantitative way.

Acknowledgments. This research was funded by a Wenner-Gren Foundation Dissertation Fieldwork Grant and the Royal Anthropological Institute's Emslie Horniman Anthropological Scholarship Fund. This article was written while I was a postdoctoral fellow at the University of Toronto, where I was funded by a W. Garfield Weston Postdoctoral Fellowship in Northern Archaeological Research. I thank Colleen Batey for her excellent mentorship as well as Max Friesen and anonymous reviewers for their thoughtful feedback on the text. Louis-Vincent Laperrière-Désorcy graciously aided me with the translation of the French abstract. I am thankful for the Government of Nunavut, The Rooms, the Canadian Museum of History, and the Prince of Wales Northern Heritage Centre for providing access to the material and graciously supplying site data and artifact catalogs. Artifact photograph permissions are courtesy of the Government of Nunavut and the Canadian Museum of History.

Data Availability Statement. All objects used in this article are located at The Rooms, the Canadian Museum of History, and the Canadian Museum of Nature. The dataset is available at DOI:10.17632/6c65yc5vs3.1.

References Cited

Ameen, Carly, Tatiana R. Feuerborn, Sarah K. Brown, Anna Linderholm, Ardern Hulme-Beaman, Ophélie Lebrasseur, Mikkel-Holger S. Sinding, Zachary T. Lounsberry, Audrey T. Lin, Martin Appelt, Lutz Bachmann, Matthew Betts, Kate Britton, John Darwent, Rune Dietz, Merete Fredholm, Shyam Gopalakrishnan, Olga I. Goriunova, Bjarne Grønnow, James Haile, Jón Hallsteinn Hallsson, Ramona Harrison, Mads Peter Heide-Jørgensen, Rick Knecht, Robert J. Losey, Edouard Masson-MacLean, Thomas H. McGovern, Ellen McManus-Fry, Morten Meldgaard, Åslaug Midtdal, Madonna L. Moss, Iurii G. Nikitin, Tatiana Nomokonova, Albína Hulda Pálsdóttir, Angela Perri, Aleksandr N. Popov, Lisa Rankin, Joshua D. Reuther, Mikhail Sablin, Anne Lisbeth Schmidt, Scott Shirar, Konrad Smiarowski, Christian Sonne, Mary C. Stiner, Mitya Vasyukov, Catherine F. West, Gro Birgit Ween, Sanne Eline Wennerberg, Øystein Wiig, James Woollett, Love Dalén, Anders J. Hansen, M. Thomas P. Gilbert, Benjamin N. Sacks, Laurent Frantz, Greger Larson, Keith Dobney, Christyann M. Darwent, and Allowen Evin

2019 Specialized Sledge Dogs Accompanied Inuit Dispersal across the North American Arctic. *Proceedings of the Royal Society B* 296:1–10.

Appelt, Martin, Eric Damkjar, and T. Max Friesen

2016 Late Dorset. In *Oxford Handbook of the Prehistoric Arctic*, edited by T. Max Friesen and Owen K. Mason, pp. 783–806. Oxford University Press, Oxford.

Appelt, Martin, and Hans Christian Gulløv

2009 Tunit, Norsemen, and Inuit in Thirteenth-Century Northwest Greenland: Dorset between the Devil and the Deep Sea. In *The Northern World, AD 900–1400*, edited by Herbert Maschner, Owen K. Mason, and Robert McGhee, pp. 300–320. University of Utah Press, Salt Lake City.

Appelt, Martin, Hans Christian Gulløv, and Hans Kapel

1998 The Gateway to Greenland: Report on the Field Season 1996. In *Man, Culture and Environment in Ancient Greenland*, edited by Jette Arneborg and Hans Christian Gulløv, pp. 136–153. Danish Polar Center, Copenhagen.

Appelt, Martin, and Hans Christian Gulløv

1999 *Late Dorset in High Arctic Greenland*. Danish Polar Center, Copenhagen.

Appelt, Martin, Jens Fog Jensen, Mikkel Myrup, Henning Haack, Mikkel Sørensen, and Michelle Taube

2015 *The Cultural History of the Innaanganeq/Cape York Meteorite - Technical Report*. Danish National Museum, Copenhagen.

Bassett, Madeleine G., Christopher M. Stevenson, and Laure Dussubieux

2019 Re-examining Trade Networks in Late Woodland Virginia (900–1600 CE): An LA-ICP-MS Analysis of Copper Artifacts. *Journal of Archaeological Science: Reports* 27. DOI:10.1016/j.jasrep.2019.101967.

Boas, Franz U.

1965 [1888] *The Central Eskimo*. University of Nebraska Press, Lincoln.

Boslough, Mark 2013 Greenland Pt Anomaly May Point to Noncataclysmic Cape York Meteorite Entry. *Proceedings of the National Academy of Sciences of the United States of America* 110:E5035. DOI:10.1073/pnas.1320328111.

Buchwald, Vagn F.

2001 *Ancient Iron and Slags of Greenland*. Museum Tusculanum Press, Copenhagen.

2005 *Iron and Steel in Ancient Times*. Royal Danish Academic of Science and Letters, Copenhagen.

Buchwald, Vagn F., and Gert Mosdal

1985 *Meteoritic Iron, Telluric Iron and Wrought Iron in Greenland*. Museum Tusculanum Press, Copenhagen.

Clark, Donald W.

1975 *Archaeological Reconnaisance in Northern Interior District of Mackenzie: 1969, 1970 and 1972*. Mercury Series 27. National Museums of Canada, Ottawa.

Cooper, H. Kory

2012 Innovation and Prestige among Northern Hunter-Gatherers: Late Prehistoric Native Copper Use in Alaska and Yukon. *American Antiquity* 77:565–590.

2016 Arctic Archaeometallurgy. In *The Oxford Handbook of the Prehistoric Arctic*, edited by T. Max Friesen and Owen K. Mason, pp. 175–196. Oxford University Press, Oxford.

Cooper, H. Kory, Owen K. Mason, Victor Mair, John F. Hoffecker, and Robert J. Speakman

2016 Evidence of Eurasian Metal Alloys on the Alaskan Coast in Prehistory. J*ournal of Archaeological Science* 74:176–183.

Cooper, H. Kory, Jenna Ling, and Marah Brenneman

2015 Is That Awl? Experimental Insight into Native Copper Working and Innovation. *Ethnoarchaeology* 7:3–20.

Damkjar, Eric

2000 A Survey of Late Dorset Longhouses. In *Identities and Cultural Contacts in the Arctic*, edited by Martin Appelt, Joel Berglund, and Hans Christian Gulløv, pp. 170–180. Danish Polar Center, Copenhagen.

2005 Late Dorset Longhouses: A Look Inisde. In *Contributions to the Study of Dorset Palaeo-Eskimos*, edited by Patricia D. Sutherland, pp. 147–165. Mercury Series 167. Canadian Museum of Civilization, Gatineau, Quebec.

Darwent, John, Genevieve M. LeMoine, Christyann M. Darwent, and Hans Lange

2019 Late Dorset Deposits at Iita: Site Formation and Site Destruction in Northwestern Greenland. *Arctic Anthropology* 56(1):96–118.

Darwent, John, James M. Savelle, Christyann M. Darwent, Arthur S. Dyke, Hans Lange, Genevieve M. LeMoine, and Claude Pinard

2018 Late Dorset Triangular Midpassages in the Canadian Arctic and Northwest Greenland: Origins and Dispersal. *American Antiquity* 83:525–535.

Desrosiers, Pierre M.

2017 The Dispersal of Ramah Chert by Paleoeskimo People. In *Ramah Chert: A Lithic Odyssey*, edited by Jenneth E. Curtis and Pierre M. Desrosiers, pp. 85–116. Avataq Cultural Institute, Montreal.

Dyakonov, Viktor M., Kunney A. Pestereva, Alexander D. Stepanov, and Owen K. Mason

2019 The Spread of Metal and Metal Production Technology in the Far Northeast and Alaska over the Second Millennium BC to the First Millennium AD. *World Archaeology* 51:355–381.

Farrell, Thomas F. G., and Peter Jordan

2016 Prehistoric Uses of Circumpolar Mineral Resources: Insights and Emerging Questions from Arctic Archaeology. *Polarforschung* 86(1):1–13.

Fitzhugh, William W.
1975 A Comparative Approach to Northern Maritime Adaptations. In *Prehistoric Maritime Adaptations of the Circumpolar Zone*, edited by William W. Fitzhugh, pp. 339–386. Mouton Publishers, The Hague, Netherlands.
1981 Smithsonian Archaeological Surveys: Central and Northern Labrador, 1980. *Archaeology in Newfoundland and Labrador* 1:26–44.
1994 Staffe Island 1 and the Northern Labrador Dorset-Thule Succession. In *Threads of Arctic Prehistory: Papers in Honour of William E. Taylor, Jr.*, edited by David A. Morrison and Jean-Luc Pilon, pp. 239–268. Mercury Series 149. Canadian Museum of Civilization, Hull, Quebec.
Franklin, Ursula F., Ellen Badone, Ruth M. Gotthardt, and Brian W. D. Yorga
1981 *An Examination of the Prehistoric Copper Technology and Copper Sources in Western Arctic and Subarctic North America*. Mercury Series 101. National Museums of Canada, Ottawa.
Friesen, T. Max
2004 Contemporaneity of Dorset and Thule Cultures in the North American Arctic: New Radiocarbon Dates from Victoria Island, Nunavut. *Current Anthropology* 45:685–691.
2015 On the Naming of Arctic Archaeological Traditions: The Case for Paleo-Inuit. *Arctic* 68(3):iii–iv.
2019 Radiocarbon Evidence for Fourteenth-Century Dorset Occupation in the Eastern North American Arctic. *American Antiquity* 85:1–19. DOI:10.1017/aaq.2019.88.
Friesen, T. Max, and Charles D. Arnold
2008 The Timing of the Thule Migration: New Dates from the Western Canadian Arctic. *American Antiquity* 73:527–538.
Friesen, T. Max, and Michael J. E. O'Rourke
2019 Biogeographic Barriers and Coastal Erosion: Understanding the Lack of Interaction between the Eastern and Western Regions of the North American Arctic. *World Archaeology* 51:484–501.
Greenfield, Haskel J.
1999 The Origins of Metallurgy: Distinguishing Stone from Metal Cut-Marks on Bones from Archaeological Sites. *Journal of Archaeological Science* 26:797–808.
2000 The Origins of Metallurgy in the Central Balkans Based on the Analysis of Cut Marks on Animal Bones. *Environmental Archaeology* 5:93–106.
Grønnow, Bjarne
2017 *The Frozen Saqqaq Sites of Disko Bay, West Greenland*. Museum of Tusculanum Press, Copenhagen.
Gullason, Lynda
1999 Engendering Interaction: Inuit-European Contact in Frobisher Bay, Baffin Island. PhD dissertation, Department of Anthropology, McGill University, Montreal.
Harp, Elmer
1958 Prehistory in the Dismal Lake Area, N.W.T., Canada. *Arctic* 11:219–249.
1974 A Late Dorset Copper Amulet from Southeastern Hudson Bay. *Folk* 16–17:33–44.
Hill, Mark A., Mark F. Seeman, Kevin C. Nolan, and Laure Dussubieux
2018 An Empirical Evoluation of Copper Procurement and Distribution: Elemental Analysis of Scioto Valley Hopewell Copper. *Archaeological and Anthropological Sciences* 10:1193–1205.
Hodgetts, Lisa, and Patricia Wells
2016 Priscilla Renouf Remembered: An Introduction to the Special Issue with a Note on Renaming the Palaeoeskimo Tradition. *Arctic* 69(5):i–vi.
Jenness, Diamond
1925 A New Eskimo Culture in Hudson Bay. *Geographical Review* 15:428–437
Jolicoeur, Patrick C.
2019 Once Upon a Time in the Arctic: An Analysis of Late Dorset Metal Exchange and Interaction in the Eastern Arctic (AD 500–1300). PhD dissertation, Department of Archaeology, University of Glasgow, Scotland.
Kjær, Kurt H., Nicolai K. Larsen, Tobias Binder, Anders A. Bjørk, Olaf Eisen, Mark A. Fahnestock, Svend Funder, Adam A. Gard, Henning Haack, Veit Helm, Michael Houmark-Nielsen, Kristian K. Kjeldsen, Shfaqat A. Kahn, Horst Machguth, Iain McDonald, Mathieu Morlighem, Jérémie Mouginot, John D. Paden, Tod E. Waight, Christian Weikusat, Eske Willerslev, and Joseph A. MacGregor
2018 A Large Impact Crater beneath Hiawatha Glacier in Northwest Greenland. *Science Advances* 4(11): eaar8173. DOI:10.1126/sciadv.aar8173.
Lebedintsev, Aleksandr I.
2000 *Early Maritime Cultures of Northwestern Priokhot'e*, U.S. Dept. of the Interior, National Park Service, Alaska Regional Office, Shared Beringian Heritage Program, Anchorage.
LeMoine, Genevieve M.
2005 Understanding Dorset from a Different Perspective: Worked Antler, Bone, and Ivory. In *Contributions to the Study of the Dorset Palaeo-Eskimos*, edited by Patricia D. Sutherland, pp. 133–146. Mercury Series 167. Canadian Museum of Civilization, Hull, Quebec.
LeMoine, Genevieve M., James Helmer, and Bjarne Grønnow
2003 Late Dorset Architecture on Little Cornwallis Island. *Études/Inuit/Studies* 27:255–280.
Levine, Mary A.
1999 Native Copper in the Northeast: An Overview of Potential Sources Available to Indigenous Peoples. In *The Archaeological Northeast*, edited by Mary A. Levine, Kenneth E. Sassaman, and Michael S. Nassaney, pp. 183–200. Bergin and Garvey, Westport, Connecticut.
Linnamae, Urve
1975 *The Dorset Culture: A Comparative Study in Newfoundland and the Arctic*. Newfoundland Museum, St. John's, Newfoundland, Canada.
Loring, Stephen
2002 "And They Took Away the Stones from Ramah": Lithic Raw Material Sourcing and Eastern Arctic Archaeology. In *Honoring Our Elders*, edited by William W. Fitzhugh, Stephen Loring, and Daniel Odess, pp. 163–186. Arctic Studies Center, Washington DC.
2017 To the Uttermost Ends of the Earth . . . Ramah Chert in Time and Space. In *Ramah Chert: A Lithic Odyssey*, edited by Jenneth E. Curtins and Pierre M. Desrosiers, pp. 169–220. Avataq Cultural Institute, Montreal.
Lothrop, Jonathan C., Adrian L. Burke, Susan Winchell-Sweeney, and Gilles Gauthier
2018 Coupling Lithic Sourcing with Least Cost Path Analysis to Model Paleoindian Pathways in Northeastern North America. *American Antiquity* 83:462–484.

Lulewicz, Jacob
2019 The Social Networks and Structural Variation of Mississippian Sociopolitics in the Southeastern United States. *Proceedings of the National Academy of Sciences of the United States of America* 116:6707–6712.
Mary-Rousselière, Guy
1979 A Few Problems Elucidated . . . and New Questions Raised by Recent Dorset Finds in the North Baffin Island Region. *Arctic* 32:22–32.
2002 *Nunguvik et Saatut: Sites Paleoeskimaux de Navy Board Inlet, Île de Baffin*. Canadian Museum of Civilization, Hull, Quebec.
Mason, Owen K.
1998 The Contest between the Ipiutak, Old Bering Sea, and Birnirk Polities and the Origin of Whaling during the First Millennium A.D. along Bering Strait. *Journal of Anthropological Archaeology* 17:240–325.
2000 Ipiutak/Birnirk Relationships in Northwest Alaska: Master and Slave or Partners in Trade? In *Identities and Cultural Contacts in the Arctic*, edited by Martin Appelt, Joel Berglund, and Hans Christian Gulløv, pp. 229–251. Danish National Museum and Danish Polar Center, Copenhagen.
Maxwell, Moreau S.
1973 *Archaeology of the Lake Harbour District, Baffin Island*. National Museum of Man, Ottawa.
1976 Pre-Dorset and Dorset Artifacts: The View from Lake Harbour. In *Eastern Arctic Prehistory: Paleoeskimo Problems*, edited by Moreau S. Maxwell, pp. 58–78. Smithsonian Institution, Washington, DC.
1985 *Prehistory of the Eastern Arctic*. Academic Press, London.
McCaffery, Moira
2011 Ancient Social Landscapes in the Eastern Subarctic. In *Hunter-Gatherer Archaeology as Historical Process*, edited by Kenneth E. Sassaman and Donald H. Holly, pp. 143–166. University of Arizona Press, Tucson.
McCartney, Allen P.
1988 Late Prehistoric Metal Use in the New World Arctic. In *Late Prehistoric Development of Alaska's Native People*, edited by Robert D. Shaw, Roger K. Harrit, and Don E. Dummond, pp. 88–123. Alaska Historical Commission, Anchorage.
1991 Canadian Arctic Trade Metal: Reflections of Prehistoric to Historic Social Networks. In *Metals in Society: Theory Beyond Analysis*, edited by Robert M. Ehrenreich, pp. 26–44. Museum of Applied Science Center for Archaeology, Philadelphia.
McCartney, Allen P., and Jerome Kimberlin
1988 The Cape York Meteorite as a Metal Source for Prehistoric Canadian Eskimos. *Meteoritics* 23:288.
McCartney, Allen P., and David J. Mack
1973 Iron Utlization by Thule Eskimos of Central Canada. *Antiquity* 38:328–339.
McGhee, Robert
1981 *The Dorset Occupations in the Vicinity of Port Refuge, High Arctic Canada*. Mercury Series 105. National Museums of Canada, Ottawa.
1984 The Timing of the Thule Migration. *Polarforschung* 54(1):1–7.
2009 When and Why Did the Inuit Move to the Eastern Arctic. In *The Northern World, AD 900–1400*, edited by Herbert Maschner, Owen K. Mason, and Robert McGhee, pp. 155–163. University of Utah Press, Salt Lake City.
Morey, Darcy F., and Kim Aaris-Sørensen
2002 Paleoeskimo Dogs of the Eastern Arctic. *Arctic* 55:44–56.
Murray, Maribeth S.
1999 Local Heroes: The Long-Term Effects of Short-Term Prosperity—An Example from the Canadian Arctic. *World Archaeology* 30:466–483.
Nagle, Christopher L.
1984 Lithic Raw Materials Procurement and Exchange in Dorset Culture along the Labrador Coast. PhD dissertation, Department of Anthropology, Brandeis University, Waltham, Massachusetts.
Odess, Daniel
1998 The Archaeology of Interaction: Views from Artifact Style and Material Exchange in Dorset Society. *American Antiquity* 63:417–435.
Park, Robert W.
1993 The Dorset-Thule Succession in Arctic North America: Assessing Claims for Culture Contact. *American Antiquity* 58:203–234.
Park, Robert W.
2003 The Dorset Culture Longhouse at Brooman Point, Nunavut. *Études/Inuit/Studies* 27:239–253.
Park, Robert W.
2016 The Dorset-Thule Transition. In *The Oxford Handbook of the Prehistoric Arctic*, edited by T. Max Friesen and Owen K. Mason, pp. 808–826. Oxford University Press, Oxford.
Park, Robert W., and Pauline M. Mousseau
2003 How Small Is Too Small? Dorset Culture "Miniature" Harpoon Heads. *Canadian Journal of Archaeology* 27:258–272.
Park, Robert W., and Douglas R. Stenton
1999 *Ancient Harpoon Heads of the Arctic*. Parks Canada, Pangnirtung, Nunavut, Canada.
Pike, Matthew D., H. Kory Cooper, and Garrett Hunt
2019 Defining a "Reasonable Geographic Framework": Path Distance as Native Copper Provenance in the Arctic, Subarctic, and Northwest Coast. *Journal of Archaeological Science: Reports* 26. DOI:10.1016/j.jasrep.2019.101903.
Pinard, Claude, and Daniel Gendron
2009 The Dorset Occupation on the South Shore of the Hudson Strait: How Late? In *The Northern World, AD 900–1400*, edited by Herbert Maschner, Owen K. Mason, and Robert McGhee, pp. 249–259. University of Utah Press, Salt Lake City.
Plumet, Patrick
1985 *Archéologie de 'Ungava: Le Site de la Pointe aux Bélougas (Qilalugarsiuvik) et les Maisons Longues Dorsétiennes*. Collection PaléoQuébec 18. Musée d'Archéologie, Montreal.
Plumet, Patrick, and Serge Lebel
1997 Dorset Tip Fluting: A Second "American" Invention. *Arctic Anthropology* 34(2):103–144.
Raghavan, Maanasa, Michael DeGiorgio, Anders Albrechtsen, Ida Moltke, Pontus Skoglund, Thorfinn S. Korneliussen, Bjarne Grønnow, Martin Appelt, Hans Christian Gulløv, T. Max Friesen, William Fitzhugh, Helena Malmström, Simon Rasmussen, Jesper Olsen, Linea Melchior, Benjamin T. Fuller, Simon M. Fahrni, Thomas Stafford, Vaughan Grimes, M. A. Priscilla Renouf, Jerome Cybulski, Niels Lynnerup, Marta Mirazon Lahr, Kate Britton, Rick Knecht, Jette Arneborg, Mait Metspalu, Omar E. Cornejo, Anna-Sapfo Malaspinas, Yong Wang, MortenRasmussen,

Vibha Raghavan, Thomas V. O. Hansen, Elza Khusnutdinova, Tracey Pierre, Kirill Dneprovsky, Claus Andreasen, Hans Lange, M. Geoffrey Hayes, Joan Coltrain, Victor A. Spitsyn, Anders Götherström, Ludovic Orlando, Toomas Kivisild, Richard Villems, Michael H. Crawford, Finn C. Nielsen, Jørgen Dissing, Jan Heinemeier, Morten Meldgaard, Carlos Bustamante, Dennis H. O'Rourke,Mattias Jakobsson, M. Thomas P. Gilbert, Rasmus Nielsen, and Eske Willersle2014 The Genetic Prehistory of the New World Arctic. *Science* 345. DOI:10.1126/science.1255832.

Renouf, M. A. Priscilla, and Trevor Bell
2008 Dorset Palaeoeskimo Skin Processing at Phillip's Garden, Port au Choix, Northwestern Newfoundland. *Arctic* 61:36–47.

Rowley, Susan
1994 The Sadlermiut: Mysterious or Misunderstood? In In *Threads of Arctic Prehistory: Papers in Honour of William E. Taylor, Jr.*, edited by David A. Morrison and Jean-Luc Pilon, pp. 361–384. Mercury Series 149. Canadian Museum of Civilization, Hull, Quebec.

Ryan, Karen
2003 An Overview of Palaeoeskimo Architectural Remains in the Central Low Canadian Arctic. *Études/Inuit/Studies* 27:29–65.

Savelle, James M., Arthur S. Dyke, Peter J. Whitridge, and Melanie Poupart
2012 Paleoeskimo Demography on Western Victoria Island, Arctic Canada: Implications for Social Organization and Longhouse Development. *Arctic* 65:167–181.

Schledermann, Peter
1990 *Crossroads to Greenland*. Arctic Institute of North America, Calgary.

Schledermann, Peter, and Karen McCullough
2003 Inuit-Norse Contact in the Smith Sound. In *Contact, Continuity, and Collapse*, edited by James H. Barrett, pp. 183–206. Brepols, Turnhout, Belgium.

Sutherland Patricia D.
2000 Strands of Culture Contact: Dorset-Norse Interactions in the Canadian Eastern Arctic. In *Identities and Cultural Contacts in the Arctic*, edited by Martin Appelt, Joel Berglund, and Hans Christian Gulløv, pp. 159–169. Danish Polar Center, Copenhagen.
2002 Nunguvik and Saatut Revisted. In *Nunguvik and Saatut: Sites paléoeskimaux de Navy Board Inlet, île de Baffin*, Guy Mary-Rousselière, pp. 115–119. Canadian Museum of Civilization, Gatineau, Quebec.
2008 Norse and Natives in the Eastern Arctic. In *The Viking World*, edited by Stefan Brink and Neil Price, pp. 613–619. Routledge, London.
2009 The Question of Contact between Dorset Paleo-Eskimos and Early Europeans in the Eastern Arctic. In *The Northern World, AD 900–1400*, edited by Herbert Maschner, Owen K. Mason, and Robert McGhee, pp. 279–299. University of Utah Press, Salt Lake City.

Sutherland, Patricia D., Peter H. Thompson, and Patricia A. Hunt
2014 Evidence of Early Metalworking in Arctic Canada. *Geoarchaeology* 30:74–78.

Taçon, Paul S. C.
1983 An Analysis of Dorset Art in Relation to Prehistoric Culture Stress. *Études/Inuit/Studies* 7:41–65.

Taylor, William, E.
1967 Summary of Archaeological Field Work on Banks and Victoria Islands, Arctic Canada 1965. *Arctic Anthropology* 4(1):221–243.
1968 *The Arnapik and Tyara Sites: An Archaeological Study of Dorset Culture Origins*. Society for American Archaeology, Salt Lake City, Utah.

Tuck, James A.
1976 *Newfoundland and Labrador Prehistory*. National Museum of Man, Ottawa.

Walder, Heather
2019 Picking Up the Pieces: Intercultural Interaction in the Great Lakes Region Examined through Copper-Based Metal Artifacts. *International Journal of Historical Archaeology* 23:316–342.

Whitridge, Peter J.
1999 The Construction of Social Difference in a Prehistoric Inuit Whaling Community. PhD dissertation, Department of Anthropology, Arizona State University, Tempe.
2002 Gender, Households, and the Material Construction of Social Difference. In *Many Faces of Gender: Roles and Relationships through Time in Indigenous Northern Communities*, edited by Lisa Frink, Rita S. Shepard, and Gregory A. Reinhardt, pp. 165–191. University Press of Colorado, Boulder; University of Calgary Press, Calgary.

Submitted February 17, 2020; Revised May 4, 2020; Accepted May 5, 2020